# *Reforest the Bluegrass*
## Empowerment of the Citizen Watershed Manager

H. David Gabbard, P.E.
Division of Engineering
Lexington-Fayette Urban County Government
Lexington, Kentucky 40507-1310

Angela Poe
Bluegrass PRIDE
Lexington, Kentucky 40591

## Abstract

In 1992, the National Pollutant Discharge Elimination System permitting program of the Clean Water Act sought to address non-point source pollution from stormwater discharges. Lexington, Kentucky, was a Phase I city that was required to file for a permit under this program. The permit required the Lexington-Fayette Urban County Government (LFUCG) to assess the environmental damage to its water resources and develop urban stormwater pollution prevention programs using best management practices (BMPs) to the maximum extent practicable (MEP).

The assessments showed that aquatic life had been greatly affected by the alteration of stream corridors. From the filling of floodplains and the alteration of stream morphology to the clearing of streambanks of unwanted vegetation, human activities had greatly diminished optimal habitat conditions. It was determined that one of the most effective BMPs to reverse the affects of these activities was to restore riparian forest cover to the stream channels. However, two centuries of agricultural uses of the land has left an aesthetic, "The Bluegrass Aesthetic," in which citizens expect creeks to be *seen* and *heard*. Rolling hills are covered with carefully mowed non-native bluegrass and fescue; streambanks are mowed down to the water's edge; and trees dot the landscape in various places – but do line fencerows and driveways.

Because of the "Bluegrass Aesthetic," citizens regard urban streams as mostly open, stormwater ditches and that it is the government's responsibility to keep them clean. Most property owners have applied the "Bluegrass Aesthetic" to every lawn – mowing or weed-eating down to the water's edge. Furthermore, the little remaining Fayette County riparian forests contain a dense understory of invasive bush honeysuckle. Because of community concerns regarding the concealing of illicit activity, many forested stands with bush honeysuckle have been removed.

The final constraint was that the LFUCG Division of Engineering did not have a stormwater budget that would allow for large public works projects to address major riparian planting programs. However, even if the DOE had the budget for such projects, it would have to overcome negative public perceptions regarding early successional growth.

The solution was to create the *Reforest the Bluegrass* program in the spring of 1999. This is a Public Works program that empowers citizens to protect their own water resources. By using citizens to plant the forests, there is a sense of ownership of the project and that support is critical in the early stages of forest growth – when the project looks "weedy" and contrary to the "Bluegrass Aesthetic." Furthermore, it educates and trains citizens why to plant trees to protect their properties along streams or "ditches" (there are 560 miles of blueline streams in Fayette County).

The success of the *Reforest the Bluegrass* program has been phenomenal! Since April 1999, 3,975 volunteers have been trained as urban watershed managers in eight different events. They have planted over 108,000 trees in 140 floodplain acres. The LFUCG has spent approximately $85,000 of local taxpayer dollars and other $50,000 has been raised via donations or grants. If the project had been contracted out (as some first suggested), the project would have cost over $650,000!

## Introduction

The creation for the *Reforest the Bluegrass* program is founded in the need for the LFUCG to comply with various components of the Clean Water Act. The LFUCG has been monitoring the conditions of the waters of Fayette County since it was first required to apply for a stormwater discharge permit in 1992. This permit serves the purposes of qualifying and quantifying urban sources of non-point source pollution conveyed by stormwater runoff. Other non-point sources in Fayette County are comprised of agricultural sources from tobacco farming, cattle grazing, and the equine industry.

*Reforest the Bluegrass* addresses three important goals facing large urban communities:

- An NPDES municipal stormwater discharge permit to control urban, non-point source pollution;
- Restoration of streams listed on the 303(d) lists of each state; and
- Changing the landscaping habits of citizens to protect water resources and value riparian forests.

### *Goal: Urban Non-point Source Pollution Control – Municipal Stormwater Permit*

A stormwater discharge permit is required as part of the Water Quality Act of 1987. Medium sized cities with populations greater than 100,000 and less than 250,000 which had municipal separate storm sewer systems (MS4s) were required to apply for permits as a phased approach to the management of water quality within the United States. Earlier legislation and programs (1972 Clean Water Act and the National Pollutant Discharge Elimination System (NPDES)) focused on removing point sources of water pollution. The 1987 stormwater permitting requirements were designed to manage non-point source water pollution from various industrial and municipal activities.

The NPDES Stormwater Discharge Permit for the LFUCG required an assessment of the environmental damage to Fayette County water resources and develop urban stormwater pollution prevention programs using best management practices (BMPs) to the maximum extent practicable (MEP). During the assessment of the urban watershed, the following problems were identified:

1. Floodplains have been filled and developed utilizing past engineering designs that forced more flow through narrower channels thus altering and reducing the benthic macroinvertebrate habitat;

2. Tree canopy over the streams has been either eliminated, consisted of invasive bush honeysuckle; or was comprised of ornamental shrubs and trees in single rows;

3. There have been problems associated with dense communities of algae dominating the streams. Because of the high phosphorus content of the soil, the concentrations of phosphorus in the stormwater runoff quickly trigger algal growth (background phosphorus concentrations are 0.2~0.3 mg/L). Where there is full sunlight, in most places, algal mats form quickly and in abundance. However, anywhere there is tree canopy, the stream is void of algae;

4. Lexington is situated on a hill. Six 11-digit HUCs (watersheds) drain from the central part of the city out to the county line. Because all urban streams are small headwater streams, the impacts of thermal pollution, heavy metals, and dissolved oxygen-robbing algal mats have resulted in frequent fish kills and poor aquatic insect communities; and

5. The destabilized streambanks and shallow soil depths (to bedrock) have resulted in streams eroding and widening their bank widths.

In creating a watershed management program, the LFUCG would have to:

- Apply Best Management Practices (BMPs) to the Maximum Extent Practicable (MEP);
- Seek intra and inter-governmental cooperation;
- Involve public education and involvement; and
- Seek ways to reduce the use of lawn care chemicals and their impacts.

As a stormwater management program, *Reforest the Bluegrass*, addresses each of these requirements. Riparian reforestation is a BMP for water quality enhancement and requires a great deal of agency cooperation for large scale planning and implementation. Furthermore, by training citizens to perform the work, they are educated as to the necessity of riparian forests and vegetated stream buffers. As a result, these citizens are beginning to change their lawn care habits to protect the quality of water of Fayette County.

## *Goal: Restoration of Impaired Streams of the 303(d) List*

During the first three years, site selection was based upon the 303(d) listing of each of the major stream systems within Fayette County. The "303(d) list" is a compilation of stream segments determined by each state for which a Total Maximum Daily Load pollution allocation model is necessary for pollution control. Streams are listed based upon whether or not they meet designated uses – are the waters fishable and swimmable. The criteria, which determine the fishability or swimability of a given waterbody, are based upon water quality and biological assessments.

For Fayette County, stream use assessments are based mostly upon data collected as part of the requirements for the stormwater discharge permit. The data collection has been performed for the LFUCG by Commonwealth Technology, Incorporated (CTI, now Tetra Tech, Inc.). The primary indicators of stormwater pollution problems that have been found are:

- Presence of fecal coliform in streams and storm sewer outfalls;
- Fair to poor aquatic communities; and
- High nutrient and organic enrichment.

Dry and wet weather water chemistry samples indicate high levels of fecal coliforms in most streams. Biological community monitoring indicates that streams in the urban service area generally do not fully support aquatic life. Habitat evaluations indicate inadequate instream and riparian habitat to support aquatic life at some sites; at other sites, habitat is adequate but aquatic life is still poor.

As previously mentioned, nutrient enrichment is a problem because of the high phosphorus concentrations that occur naturally in the central Kentucky region. Only 7% of the streams of the United States are limestone-based systems. And of those, central Kentucky is an oddity because the upper limestone layer has a high phosphorus content. Groundwater in the area has a phosphorus concentration of 0.2~0.3 mg/L, two to three times higher than the 0.1 mg/L concentration that triggers algal blooms elsewhere in the country.

303(d) List of Waters for TMDL Development

For the initial selection of reforestation sites, the 1998 303(d) listed streams were examined for Fayette County:

First Priority (Does not support one or more designated uses, KDEP 1998):

| | Impaired Use | Pollutants of Concern |
|---|---|---|
| Unnamed Tributary to Baughman's Fork | Aquatic Life | Organic Enrichment/Low DO<br>Nutrients |
| Cane Run | Aquatic Life<br>Swimmable | Organic Enrichment/Low DO<br>Pathogens |
| Town Branch | Aquatic Life<br>Swimmable | Organic Enrichment/Low DO<br>Nutrients<br>Pathogens |
| Wolf Run | Swimmable | Pathogens |

Second Priority (Partially supports designated use)

| | Impaired Use | Pollutants of Concern |
|---|---|---|
| West Hickman | Aquatic Life | Habitat Alteration<br>Siltation |

## *Goal: Alteration of Human Habitat Habits*

Over 200 hundred years ago, the central Kentucky plateau region was a savannah covered in mostly buffalo clover and cane breaks. However, along the stream corridors were dense hardwood forests –oak-hickory forests. With the settlement of the area, the cane breaks and dense riparian forests were cleared for livestock grazing and cropland. Furthermore, it was discovered that the rich soils from the weathering of limestone layers prevalent in this region resulted in exceptional land upon which to graze and raise thoroughbred racing horses. With these types of agricultural uses for the land, trees were relegated to fencerows and driveways. Also, forests were left in hard-to-reach or unfarmable areas. After over a hundred years of this change in land cover, the "Bluegrass Aesthetic" was born – rolling hills, mowed fields of non-native Bluegrass, and a few trees dotting the landscape.

Almost all modern property owners have applied the "Bluegrass Aesthetic" to their lawns – mowing or weed-eating down to the water's edge with a few trees here and there. Citizens have viewed urban streams as open ditches and that it is the government's responsibility to keep them clean. Furthermore, the limited existing Fayette County riparian forests contain a dense understory of invasive, non-native bush honeysuckle. These areas have been used for concealing illicit activity and the Parks and Recreation Department and neighborhood associations have previously thinned out these areas to make them safer and more aesthetically pleasing. Therefore, any education in regards to the use of riparian buffers must address the impacts of the modern, chemically-addicted lawn.

It should also be noted that as part of any NPDES stormwater discharge permit, the permittee is required by the Clean Water Act to create educational programming to alter the lawn care practices of the urban area to reduce the use of fertilizers and pesticides. Therefore, riparian buffer education and implementation by citizens is a positive way to affect meaningful change without a lot of effort put into informing citizens what they are doing wrong.

## *Reforest the Bluegrass* – The Early Years

### *RTB 1999*

With the consideration of all the aforementioned goals, discussions began with the LFUCG Division of Parks and Recreation as to a suitable area to begin work. The reason the Parks department was approached was that it was the only division of the LFUCG that owned and maintained long stretches of stream corridors. It was determined that the first year's event would be performed along a "ribbon park" which had been donated to the LFUCG as part of a commercial development. The University of Kentucky was converting agricultural land, Cold Stream Research Farm, into a commercial "research park" along three miles of Cane Run Creek in northeastern Lexington. Because the floodplains were undevelopable, the University gave the floodplain areas to the LFUCG as greenspace with the condition that it is for passive recreation: trails, meadow areas, riparian forests, etc.

A local landscape architecture firm, John Carman and Associates, was hired by Parks and Recreation to create the design. Even though the design showed a riparian buffer strip along the three miles of stream corridors, no one had ever planted that many trees before and Parks did not have a budget to purchase the trees. Up until that time, all trees which were planted on Park property were saplings or greater in size. Therefore it was considered impracticable to plant forests of large caliper trees – but it was nice to look at

on paper. It was decided that the Cold Steam Park would be a good proving ground for the project. After all, this land had not been open to the public previously so if our project failed, no one would really notice.

Even though early planning was chaotic and there was still an on-going discussion as to whether or not to involve the public (the Urban Forester wanted to hire migrant workers to plant the seedlings – the Environmental Engineer wanted the "public outreach" component for his stormwater management program), the project became an overnight success! During two weeks in April 1999, over 1,200 volunteers assisted in the installation of 45 acres of floodplain forests. 25,000 tree seedlings were planted along three miles of First Priority streams in Lexington's effort to systematic restore riparian forests along all 560 miles of streams within its borders.

## *RTB 2000 & RTB 2001*

During the following two years, another 45,000 trees were planted by training over 2,000 citizens to plant riparian forests. The site for these projects were in Masterson Station Park which has two tributaries to the Town Branch, another First Priority watershed in Fayette County. The park is the largest in Fayette County, 770 acres of rolling hills and denuded streambanks.

## *Reforest The Bluegrass 2002* – "I think we got it right this time…"

*RTB 2002*, April 6, was by far the best event yet – crystal blue skies (high of 49°F); well-trained group leaders; over 900 volunteers (planters and staff) showed up to plant 15,975 trees; and there was plenty of t-shirts, food, and supplies. The event also took place down inside two, large regional detention basins that were installed as a part of a commercial development. The detention basins and the land surrounding them were deeded over to the LFUCG as park area. Therefore, the connection between the creation of an urban forest and the control of stormwater pollution was clear for the first time.

### Project Design

*Reforest the Bluegrass* uses the wealth of knowledge and experience gained by the use of riparian, streamside, buffer systems. This "system" is nothing more than examining and mimicking the beneficial controls applied by nature to protect and preserve stream corridors. The buffer system approach uses the beneficial qualities of native vegetation to achieve desired goals of resource management.

In Figure 1, the buffer system consists of using three different kinds of vegetation to achieve the desired results. For bank stability and aquatic habitat enhancement, tree or shrub species that can tolerate a moist environment are selected. These are planted along the stream and in the floodplain. For nutrient control, optimal wildlife habitat, and slope stability, tree and shrub species are selected that prefer average to dry soil conditions. Finally, to control nutrients even more, a zone of wildflowers or native grasses (or both) are planted along the outer perimeter of the forested zone.

With this information, species are selected that will enhance the biota of the localized planting. Also, species selected are strongly influenced by their availability through the National Tree Trust. As the largest sponsor of the *Reforest the Bluegrass* ($19,800.00 worth of *donated* trees for *RTB 2002* alone), if "they've got it, we're gettin' it!" Of course, some trees, like conifers, are not native to the area and therefore are

disregarded. However, the National Tree Trust has been the largest supplier of trees. Additional tree species that are not on the list of the Tree Trust are ordered through the Kentucky Department of Forestry.

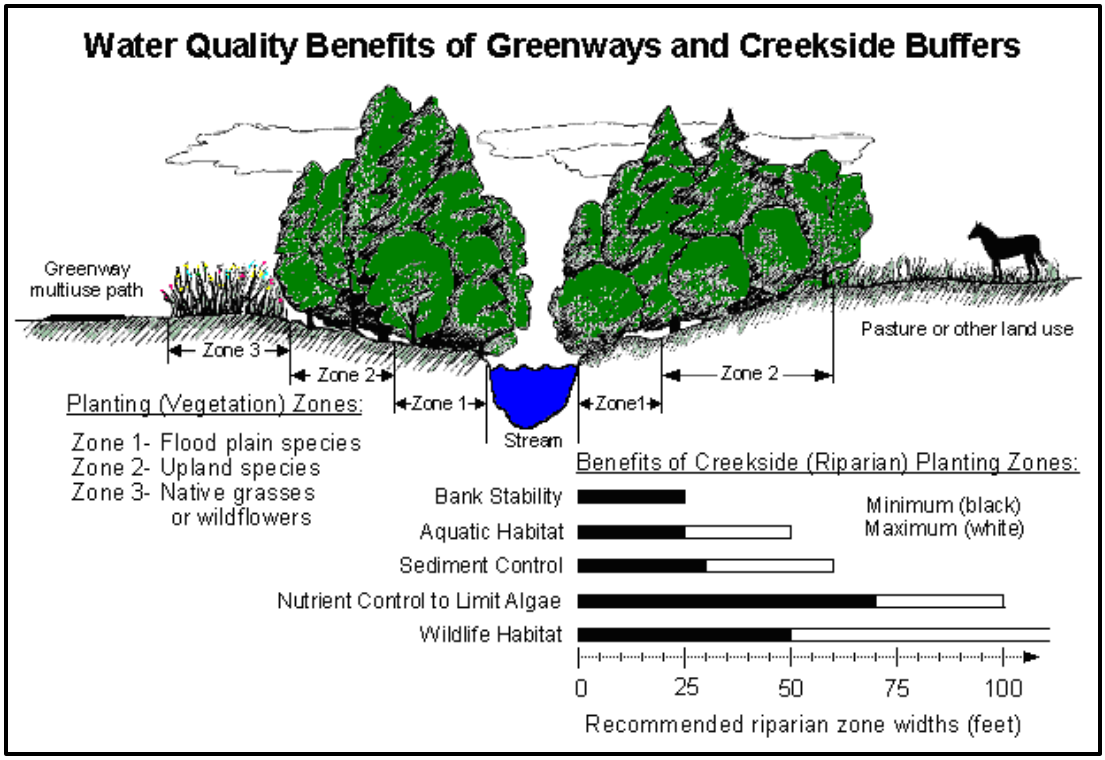


**Figure 1.** Riparian Buffer Management System, RiMS (Source: Schultz, NREM Dept. Iowa State University)

Table 1 contains a current list of tree species used (although some were not available for this past year's event). The *Recommended Planting Zones* refers to the previous discussion on buffer systems and the appropriate zones for different species. "W" means "wet" and these trees are suitable to plant in areas where the ground may be inundated for extended periods during the year. "1" is for trees that are suitable to be planted in "Zone 1," the floodplain zone. These trees will experience somewhat frequent flooding and the soils are generally moist to wet. "2" is for trees that are suitable for "Zone 2." Zone 2 trees do not tolerate root systems that are inundated with water. They prefer average to dry soil moisture conditions. "3" refers to trees suitable for "Zone 3." Zone 3 are areas that can become dry; tops of hills, south facing slopes, next to parking areas or commercial zones, etc.

## Project Implementation

### *Project Coordination*

Reforest the Bluegrass is a cooperative effort of the LFUCG Divisions of Engineering (Stormwater), Parks and Recreation, and Planning (Urban Forestry). The project also uses engineering, forestry, and ecological experts from academia and natural resources agencies to design and layout the project. Tree seedlings of various species, native to the inner Bluegrass physiographic region, are donated by the National Tree Trust. Seedlings are mixed together in bags that are sorted by planting design areas. Dots are spray painted on the restoration site at a recommended spacing and bags of trees are color-coordinated with the dots on the

ground (green dots for floodplain species, pink dots for upland species, etc). During the planning stages of the event, many community organizations and businesses assist with project organization and implementation. These organizations include Bluegrass PRIDE, Fayette County Conservation District and Extension Office, First Link of the Bluegrass, Inc., Kentucky-American Water Company, Kentucky Division of Forestry, Kentucky Utilities, Kentucky Waterways Alliance, League of Women Voters, Lexmark International, and the University of Kentucky Department of Forestry. {Each year, Kentucky-American Water Company has donated $5,000 to the project. Sponsors who contribute $5,000 or more per year are called, "Friends of the Forest."}

**Table 1.** Current tree species selected for the *Reforest the Bluegrass* project.

| Common Name | Scientific Name | Recommended Planting Zones | *RTB 2002* No. of trees ordered |
|---|---|---|---|
| Allegheny Serviceberry | *Amelanchier laevis* | 1~2 | 900 |
| Bald Cypress | *Taxodium distichum* | W | 1,000 |
| Blackgum | *Nyssa sylvatica* | W~1 | 1,000 |
| Black Locust | *Robinia pseudoacacia* | 2~3 | 500 |
| Black Walnut | *Juglans nigra* | 1 | |
| Bur Oak | *Quercus macrocarpa* | 2~3 | 1,000 |
| Buttonbush | *Cephalanthus occidentalis* | W~1 | |
| Eastern Redbud | *Cercis canadensis* | 2~3 | 1,500 |
| Green Ash | *Fraxinus pennsylvanica* | W~1 | 1,500 |
| Hackberry | *Celtis occidentalis* | 2~3 | 1,000 |
| Kentucky Coffee Tree | *Gymnocladus dioica* | 2~3 | |
| Northern Red Oak | *Quercus velutina* | 2 | 1,000 |
| Paw Paw | *Asimina triloba* | 2~3 | 1,300 |
| Pecan | *Carya illinoensis* | 1~2 | |
| Persimmon | *Diospyros virginiana* | 2~3 | |
| Red Maple | *Acer rubrum* | 1~2 | 1,000 |
| Sassafras | *Sassafras albidum* | 2~3 | 800 |
| Shagbark Hickory | *Carya ovata* | 1 | |
| Shellbark Hickory | *Carya lacinosa* | 1 | |
| Shingle Oak | *Quercus imbricaria* | 2~3 | 1,000 |
| Shumard Oak | *Quercus shumardii* | 2~3 | 1,000 |
| Silky Dogwood | *Cornus amomum* | 2 | 2,000 |
| Spicebush | *Lindera denzoin* | 1~2 | 2,000 |
| Superior Cottonwood | *Populus deltiodes* | 1 | 1,000 |
| Sugar Maple | *Acer saccharum* | 1~2 | 800 |
| Sweet Gum | *Liquidambar styraciflua* | W~1 | 1,000 |
| Sycamore | *Plantanus occidentalis* | W~1 | 1,500 |
| Tulip Poplar | *Liriodendron tulipifera* | 1~2 | 1,500 |
| White Ash | *Fraxinus americanus* | 2~3 | 1,000 |
| White Oak | *Quercus alba* | 1~2 | 1,000 |
| Wild Plum | *Prunus americana* | 2 | 1,000 |

## *Volunteer Coordination*

On the day of the planting event, volunteers are escorted into the field by Group Leaders who teach each citizen about the value of riparian forests in urban water pollution removal, the reduction of greenhouse-gases and the urban heat-island effect, and the enhancement of wildlife diversity. The volunteers are taught to use dibble bars to plant seedlings and then protect them from competitive vegetation using the tree mats. Once the group is finished planting the trees, about 20 per person, the volunteers are treated to a free t-shirt, pizza lunch, musical entertainment, the building of bird houses, and educational displays by various community organizations. Once the planting has occurred at each site, the areas are deemed as "no mow" zones, surveyed for specie survival rates, and monitored and controlled for animal browsing and impacts by invasive species.

## *Volunteer Education*

*Reforest the Bluegrass* cannot be considered successful, no matter how many trees are put into the ground, unless there is a successful educational component. *Reforest the Bluegrass* is the perfect situation in which to foster an understanding of environmental issues that will lead to long-term positive environmental behavior. Through *Reforest the Bluegrass* there is an opportunity to expand the action and awareness components inherent in a reforestation project to a deeper understanding of watershed management on both a personal and community level. At the event, volunteers are treated not only to entertainment and food, but they have many opportunities to learn more about why they are participating in the event and what a difference their time and efforts are going to make for Lexington's future.

### Themes

Communities have different environmental perspectives that should be taken into account when identifying educational themes for an event. For *Reforest the Bluegrass*, it was important for participants to obtain a historical sense of central Kentucky's landscape and to develop a basic understanding of urban stormwater management. As previously mentioned, citizens need to be shown that the "Bluegrass Aesthetic" is not natural to the area and in fact, creates the environmental damage that citizens and elected officials are constantly complaining about – eroded stream channels, odorous, decaying algae clogging the creeks, disease carrying animals and insects, and loss of "quality of life."

### The Educational Process

Understanding of the educational themes must be cultivated throughout the event process-before, during and after the planting. Citizens must be shown that it is through their own personal responsibility that they can achieve a desirable environment.

#### *Pre-Event*

Starting the educational process before the day of the event not only increases the amount learned by participants but it also helps in recruiting. If people understand why these trees need to be planted it gives them additional motivation to help.

It is important to utilize local TV and radio stations as well as local papers. Traditionally, one month prior to the event, a press conference is held. The Mayor, Vice-Mayor, major sponsors, lead organizing agencies, and other groups of importance are invited to participate. The one year that a press conference was not held, the week before *Reforest the Bluegrass*, an insert is put in the local paper. This insert contains the event location and time, a rain date, registration information, and suggestions on what to wear and bring. It also contains basic information on watersheds, stormwater management, and riparian areas, all applied to local waterways. It would be advisable to both hold the press conference and print the insert. Various TV and radio interviews are given in the weeks leading up to the event, in which information similar to that in the insert is shared.

***At the Event***

On the day of the planting event, volunteers are escorted into the field by Group Leaders who teach each participant basic information on the value of riparian forests in urban water pollution removal; the reduction of greenhouse gases; the urban heat-island effect; and the enhancement of wildlife diversity. The volunteers are taught to use dibble bars to plant seedlings and then protect them from competitive vegetation using the tree mats. The newly reforested area is not a pretty site. In fact, it looks like a field full of weeds and litter. Therefore, it is important to help volunteers appreciate the need for the forest successional process in order to create a population that is willing to tolerate, even defend, this young forest.

Once the group is finished planting trees, they are directed to a common area where there is food, entertainment, and educational booths. Various organizations from throughout the central Kentucky are asked to participate by bringing displays that will allow people to learn more about protecting and restoring our environment, particularly waterways. Groups that regularly participate in the *RTB* outreach area include: Bluegrass PRIDE, the Fayette County Conservation District, Wild Ones, Tree Guide, and environmental groups from the University of Kentucky. Each year the list expands. There is traditionally an erosion demonstration, a display board on riparian forests, an exhibit that labels and discusses the properties of the Reforest the Bluegrass tree species, and information on wildlife habitat. For RTB 2001 and 2002, there was a booth that offered children the opportunity to build birdhouses. During RTB 2002, one of the booths passed out grocery sacks so volunteers could pick up the litter that was prevalent on the site. Over 200 bags worth of litter was collected. This cleanup offered young children another activity in which they could participate.

In the outreach area, it is important to inform the adults, but it is also important to have booths targeting age groups that are too young to plant seedlings. Many families participate in *RTB*, so it is imperative to involve the entire family. If it is a successful family outing, it is likely that families will become annual participants.

A highlight of the 2002 event was the ceremonial planting of a Princeton elm, celebrating the planting of 100,000 *RTB* trees. The Mayor, Vice-Mayor, major sponsors, and other important local figures were invited to participate in this planting, which was covered by the local media. The tree is labeled with a plaque that explains its purpose and lists the "Friends of the Forest."

***Post-Event***

Now that an engaged population of volunteers has been empowered, it is important to encourage them to remember the lessons of the day and to present them with opportunities in which they can continue to be good stewards of their local environment. As people leave *Reforest the Bluegrass*, they are given a tulip

poplar, the state tree, to take home and plant. The participants are given a dichotomous tree key that aids in the identification of all species planted that day to encourage them to revisit the site. The volunteers also leave with a pamphlet that contains basic watershed and nonpoint source pollution information and details ways that they can continue their involvement in improving local waterways through adopting a stream, testing water quality, planting more trees, or labeling storm drains. Making a reforestation program an annual event is also a wonderful follow up. Many of the *Reforest the Bluegrass* volunteers are repeat participants.

## Conclusion

In just four years and eight events (four large, four small):

3,975 citizens trained!

108,000 trees planted!

140 floodplain forests restored!

$85,000 local taxpayer money appropriated!

Over $50,000 in donations raised!

The LFUCG *Reforest the Bluegrass* has captured the essence of the Clean Water Act. It has not only begun to restore the environment but it has done so through cultural change. It is a Public Works restoration project implemented by citizens. It is a successful long-term project because community leaders now understand that it is not just a "tree planting," but a project which will increase the standard of living and community goodwill. The project leaders and the citizens who become "empowered watershed managers" realize they are a part of a monumental change in community values – to take personal responsibility for the environmental health of their community for today and for the future.

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